Filing Code 5210
Date Issued September 1978

TECHNICAL NOTE

T/N 319

U.S. DEPARTMENT OF THE INTERIOR – BUREAU OF LAND MANAGEMENT

INTENSIVE FOREST INVENTORY
A Selected Bibliography

by
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Linn Pettijohn

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INTENSIVE FOREST INVENTORY

A Selected Bibliography

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ABSTRACT

A bibliography of research papers with application to or dealing with intensive forest inventory.

Subject Index

01
AITRO, Vincent P., compiler.

1977. Fifty years of forestry research: annotated bibliography of the Pacific Southwest Forest and Range Experiment Station, 1926-1975. USDA For. Serv. Gen. Tech. Rep. PSW-23, 250 pp.

Abstract

Lists 2905 publications, with annotations and subject and author indexes, issued during the first 50 years of the Pacific Southwest Forest and Range Experiment Station (formerly the California Forest and Range Experiment Station), headquartered at Berkeley, California.

This report included a section on forest measurement and vegetation surveys.

02
ALEMDAG, Seref.

1977. Formulation of stand volume increment in single examination sample plots. The Forestry Chronicle, April 1977. Vol. 53, No. 2.

Abstract

In an earlier paper (Alemdag 1975), various types of stand volume increments derived from permanent sample plot data were analyzed and defined. In this paper the procedure for formulating stand volume increments from single examination sample plots is described. Calculated past and projected future stand volume increments are defined.

03
ALEXANDER, Robert R. and Carleton B. Edminster.

1977. Regulation and control of cut under uneven-aged management. USDA For. Serv. Res. Pap. RM-182, 7 pp.

Abstract

The objective of regulation of cut is to determine the periodic yield of timber from a specified forest area. Key elements include setting a residual growing stock goal, a diameter distribution goal, and a maximum tree size goal. Allowable cut projections will include both area and volume control, especially where previously unregulated stands are being brought into a balanced structure.

04
ALEXANDER, Robert R., David Tackle, and Walter G. Dahms.

1967. Site indexes for lodgepole pine, with corrections for stand density: methodology. U.S. For. Serv. Res. Pap. RM-29, 18 pp.

Abstract

Methodology used to develop height-age curves for estimating site index of lodgepole pine is presented. Figures and tables for estimating site index corrected for stand density are also presented. Site indexes adjusted for stand density were developed from data collected in Colorado, Wyoming, Utah, Idaho, Montana and Eastern Washington and Oregon. Instructions for field use were published in U.S. For. Serv. Res. Pap. RM-24.

05
AMIDON, Elliot L., and E. Joyce Dye.

1976. Microcopying wildland maps for distribution and scanner digitizing. USDA For. Serv. Res. Pap. PSW-114, 12 pp.

Abstract

Images in graphic or printed form can be reduced in size by microcopying. Microform is a collective term for stored microimages. Conventional microform films include silver halide, nonsilver diazo, vesicular and color. Criteria for selecting the proper format include map quadrangle size and reduction ratio. Among several competing types of microforms, only microfilm and microfiche were judged acceptable for application to wildland maps. Microimages can be digitized by automatic techniques. With careful planning, it is possible to digitize automatically forest map microimages for input to computerized mapping systems. Other benefits of microcopying include a reduction in the cost of handling and shipping the original documents, savings in space, and making archival copies more lasting.

06
AMIDON, Elliot L.

1964. A computer-oriented system for assembling and displaying land management information. U.S. For. Serv. Res. Pap. PSW-17, 34 pp.

Abstract

Maps contain information basic to land management planning. By transforming conventional map symbols into numbers which are punched into cards, the land manager can have a computer assemble and display information required for a specific job. He can let a computer select information from several maps, combine it with such nonmap data as treatment cost or benefit per acre, and prepare overlays and tabulations. The report describes specific and potential uses for the system and includes cost estimates.

07
ANDERSON, James R., Ernest E. Hardy, John T. Roach, and Richard E. Witmer.

1975. A land use and land cover classification system for use with remote sensor data. US Geological Survey Circular 727.

Abstract
The framework of a national land use and land cover classification system is presented for use with remote sensor data. The classification system has been developed to meet the needs of Federal and State agencies for an up-to-date overview of land use and land cover throughout the country on a basis that is uniform in categorization at the more generalized first and second levels and that will be receptive to data from satellite and aircraft remote sensors. The proposed system uses the features of existing widely used classification systems that are amenable to data derived from remote sensor sources. It is intentionally left open-ended so that Federal, regional, State, and local agencies can have flexibility in developing more detailed land use classifications at the third and fourth levels in order to meet their particular needs and the same time remain compatible with each national system. Revision of the land use classification system as presented in U.S. Geological Survey Circular 671 was undertaken in order to incorporate the results of extensive testing and review of the categorization and definitions.

08
ANDERSON, Robert.

1975. Procedures for the Grand Platte River Basin multi-objective land use planning study. Forestry Divn., Missouri Dept. of Conservation.

Abstract
This land-use planning project was initiated with the Missouri Department of Conservation by the United States Forest Service to intensively map the forest resources of the Grand-Platte area, inventory and analyze the quality of the forest wildlife habitat conditions and to assess the existing forest watershed conditions by conducting an erosion and sedimentation survey.

09
ARNO, Stephen F. and Robert D. Pfister.

1977. Habitat Types: An improved system for classifying Montana's forests. Montana Forest and Conservation Experiment Station, Univ. of Montana, Missoula.

Abstract
Describes another system of classifying forest lands.

10
ARTHUR, Louise M., and Ron S. Boster.

1976. Measuring scenic beauty: A selected annotated bibliography. USDA For. Serv. Gen. Tech. Rep. RM-25, 34 pp.

Abstract
Of the 167 papers covered, 95 percent date from 1965. Citations are divided into four categories: literature reviews, inventory methods, public involvement, and miscellaneous. Many annotations also carry a "critical comment."

11
AVERY, Charles C., Frederic R. Larson, and Gilbert H. Schubert.

1976. Fifty-year records of virgin stand development in southwestern ponderosa pine. USDA For. Serv. Gen. Tech. Rep. RM-22. 71 pp.

Abstract
Ten periodic inventories of an unburned virgin tract of southwestern ponderosa pine near Flagstaff, Arizona, have yielded growth and mortality data on more than 3,000 trees. Fifty year of change on this 40-acre tract are documented, principally in nonmetric units, by (1) individual tree records, (2) 2.5-acre (1.01-ha) subplot summaries of basal area and tree census (tree count) data, and (3) composite stand tables which display volumes (cubic feet and board feet), census data, mortality data and causes, net periodic basal area, volume, and diameter growth. This information should be useful in modeling stand development and also as a data source for research and teaching.

12
AVERY, Thomas Eugene.

1975. National resources measurements - second edition.

Abstract
Discuss inventory in three parts: Fundamentals, Timber Measurements, and Assessing Non-Timber Resources. Text Book.

13
BAILEY, Reed W.

1962. Developing the data framework for effective timber management. misc. publication 25. Intermountain For. and Range Exp. Stn. USDA For. Service.

Abstract
The report considers the problem of inventory procedures and statistics from the standpoint of developing a data structure for management controls in addition to determining the area and volume of timber in different categories.

14
AXELTON, Elvira A.

1967. Ponderosa pine bibliography through 1965. U.S. For. Serv. Res. Pap. INT-40. 150 pp.

Abstract
This bibliography of Pinus ponderosa Laws, adds to and updates through 1965 the bibliography by Arthur L. Roe and Kenneth N. Boe, 1950. Printed and processed reports, including a few foreign publications, are listed. A subject index is supplied.

15
BARGER, Roland L., and Peter F. Ffolliott.

1969. Multiproduct timber inventory. For. Prod. J. 19:31-36, illus.

Abstract
Multiproduct timber inventory methods described provide a means of estimating the suitability of standing timber for a wide range of products. The occurrence and severity of basic stem characteristics related to quality - knots, fork, sweep, crook, and the like - provide a basis for evaluating product potential.

16
BARNARD, Joseph E. and Larry Letourneau.

1974. Data processing systems for large inventory, pp. 127-149. Inventory design and analysis: an inventory working group workshop by Society of American Foresters, Colorado State University, Ft. Collins, CO. July 23-25, 1974.

17
BEERS, T. W. and C. I. Miller.

1966. Horizontal point sampling tables. Res. Bull. No. 808, Purdue Univ., Agri. Exp. Stn., Lafayette, IN.

Abstract
The collection of "Horizontal Point Sampling Tables" presented in this bulletin is intended to provide adequate means for rapid solution of the numerical problems encountered in planning and conducting horizontal point sampling inventories. Each table was prepared by solving the applicable formula with the IBM 7094 Data Processing System of Purdue University. In every table results were rounded by half-adjusting one place to the right of the last decimal place printed.

The contents are classified as General Tables, Regional Tables of Volume Factors, and Special Tables. The General Tables are applicable wherever horizontal point sampling is put to use. The Regional Tables, on the other hand, apply specifically to timber in the North Central Region of the United States; however, they may be useful in other regions. Although the Special Tables, which provide useful conversions for slope measurements, are general in nature, they will be found to have applications in areas outside of point sampling.

18
BEERS, T. W. and C. I. Miller.

1964. Point sampling; research results, theory, and applications Res. Bull. No. 786. Purdue Univ. Agri. Stn., Lafayette, IN.

Abstract
This report assembles the necessary information required for accurate, intelligent, and efficient application of point sampling in all its ramifications. It is of interest to foresters and ecologists.

Since the concept of point sampling was first introduced to American foresters in 1952, Purdue University along with other universities and agencies has conducted research to refine and develop the theoretical and practical aspects of the system. Point Sampling: Research Results, Theory, and Applications is an organized treatment in which our research results are integrated with the chaotic body of information which has grown up around this sampling system. A number of the topics in the report are new and original, while others have previously been only partially developed. These topics include a complete discussion of basic theory, the optics of thin prisms, the calibration of prisms, the Purdue Point Sampling Block, several new field techniques and analysis methods, several refined tally systems, and associated statistical procedures.

19
BEERS, Thomas W. and Charles I. Miller.

1976. Line sampling for forest inventory. Res. Bull. No. 934. Purdue Univ. Agri. Exp. Stn., West Lafayette, IN.

Abstract
The introduction of "variable probability sampling" by Bitterlich (1947) and Grosenbaugh (1952, 1958) revolutionized forest inventory. Before the appearance of these exceptional works, foresters plodded through most forest inventories using the often inefficient fixed-size circular or rectangular plots (i.e., equal probability sampling).
Bitterlich described the use of an angle gauge to estimate stand basal area per unit of land area. He called his system the "angle-count method." Grosenbaugh explained how an angle gauge could be used to select sample trees with probability proportional to diameter

or height, and how unbiased estimates of diameter, height, volume, etc., per unit area could be obtained from the sample trees. He identified four basic systems: horizontal point sampling, horizontal line sampling, vertical point sampling, and vertical line sampling. In an attempt to unify the terminology and symbolism for these four basic systems, we published a bulletin (Beers and Miller, 1967), and called the systems "polyareal plot sampling."

20
BERNIA, B., and C. H. Winget.

1973. Forest soils and forest land management. Proc. of the 4th N. Amer. For. Soils Conference held at at Laval Univ., Quebec, Aug. 1973.

Abstract
A collection of 42 papers dealing with soil and site classification in relation to land management. Topics include soil survey and mapping, remote sensing, interpretation of data, management, forest, silvicultural planning, wildlife, conservation and management, in Canada and the United States.

21
Bureau of Land Management, US.

1974. Timber operation inventory. Missoula District, BLM.

Abstract
The purpose of an operations inventory is to gather data and assemble it so that activities such as silvicultural treatments, timber sales, reforestation projects, etc., can be logically scheduled and planned for.

Objectives. Specific operation inventory objectives are as follows:

1. To provide the resource manager with information showing the location, acreage, condition, volume, growth, and silvicultural needs in each forest type island within each tract of BLM land.

2. To provide the resource manager with "on the ground" information as a basis for scheduling forest management priorities.

3. To provide for updating and revision of forest type maps by reflecting areas of non-commercial forest cover and areas of special use.

4. To provide for identifying the biologic potential of the land by the preparation of forest habitat type maps.

5. To provide a means of systematically and thoroughly examining the forest conditions on the ground for the purpose of developing management activity plans required by the Bureau planning system.

22
BONNER, G. M.

1977. Forest inventories with large-scale aerial photographs: An operational trial in Nova Scotia. Information Report FMR-X-96 Forest Management Institute, Ottawa, Ontario.

Abstract
An inventory system using large-scale aerial photographs (LSP) as a primary source of data was tested in Nova Scotia in 1974.

Inventory specifications called for volume estimates by three species groups and four strata. The selected sampling design was a two-stage (cluster) design, used in conjunction with aerial tree volume equations. In the inventory, long strips (clusters) of LSP were obtained and plots were established on selected photos. Within each plot, tree species were identified and height and crown area of each tree were measured. The measurements were applied to tree volume equations constructed for species groups from tree section measurements, and volume and variance estimates were derived. A standard error of estimate of 10 percent, equal to the specified precision, was attained for the total population based on 120 photo plots and 9 ground plots.

Using data from ground plots, non-sampling errors associated with the LSP measurements and interpretation were evaluated. Most errors were found to result from too small a scale of photography, and from inferior image resolution. Recommendations for improved practices were made.

23
BONNER, G. M.

1972. Forest sampling and inventories; a biography. Forest Management Institute, Ottawa, Canada. Internal report FM R-24, 27 pp.

Abstract
Forest Sampling and Inventories. A list of references selected from 1945 to 1972. In addition to those articles dealing exclusively with forest sampling or inventories, many articles are included which cover related aspects, e.g., the measurement of tree characteristics on aerial photographs. Reports on methods of constructing volume tables are included.

24
BOWER, David R.

1971. Accuracy of Zeiss Telemeter Teletop; and Barr and Stroud dendrometers. SO-134 Res. Note. Southern For. Exp. Stn. For. Serv. USDA T-10210 Federal Bldg.

Abstract
Test results of the Zeiss Telemeter Teletop and Barr and Stroud dendrometers, and comparison of each.

25
BRICKELL, J. E.

1976. Bias and precision of the Barr and Stroud dendrometer under field conditions. USDA For. Serv. Res. Pap. INT-186, 46 pp.

Abstract
Information is presented and methods of testing the Barr and Stroud optical dendrometer in the field are described. Advantages and disadvantages of the Barr and Stroud compared to other means of tree measurement are discussed.

26
BRICKELL, James E.

1970. Equations and computer subroutines for estimating site quality of eight Rocky Mountain species. USDA For. Serv. Res. Pap. INT-75, 22 pp, illus.

Abstract
Presents equations and/or computer subroutines for estimating either site index and yield capability, or both, of eight Rocky Mountain species in forest inventory compilation programs, or for other purposes such as management alternative simulations. Species included; western white pine, ponderosa pine, lodgepole pine, western larch, Engelmann spruce, inland Douglas-fir, grand fir, and quaking aspen.

27
BRITISH Columbia Forest Service.

1977. Forest classification and sampling manual. Forest Inventory Division, Victoria, B.C., Canada. 246 pp.

28
BROWN, James K.

1976, June. Predicting crown weights for 11 Rocky Mountain conifers. Gen. Tech. Rep. INT-37, USDA For. Service.

Summary

For 11 conifer species in the Rocky Mountains, U.S.A., best fitting regression relationships between live and dead crown weight and d.b.h., crown length, tree height, and crown ratio were determined. High correlations resulted for functions having d.b.h. as the only independent variable. However, for most species, addition of height, crown length, and especially crown ratio improved precision. Site index and stand density improved precision of estimates for about one-half of the species; however, the gain beyond the best fitting tree dimensions was small.

Also determined were fractions of crown weight in foliage and branchwood diameter classes of 0 to 0.64 cm, 0.65 to 2.54 cm, 2.55 to 7.62 cm, and greater than 7.62 cm and their relationship to d.b.h. Fractions of needles, 0 to 0.64-cm, and 2.55- to 7.62-cm branchwood changed markedly with d.b.h. To aid determination of component fractions for whole crowns, relationships between branch basal diameters and weights of foliage and branchwood were determined.

For partitioning estimates of crown weight into foliage and branchwood by size classes, relationships between d.b.h. and cumulative fractions of foliage and branchwood were determined.

29
BROWN, James K.

1974. Handbook for inventorying downed woody material. USDA For. Serv. Gen. Tech. Rep. INT-16, 24 pp.

Abstract

This handbook tells how to inventory weights, volumes, and depths of downed woody material.

30
BRUCE, David.

1975. Evaluating accuracy of tree measurements made with optical instruments. For. Sci. Vol. 21, No. 4, December, pp. 421-426.

Abstract

Several steps are needed to assay accuracy of optical instruments used to measure tree height and upper-stem diameter. Preliminary tests establish basic instrumental and observer accuracy under easy measuring conditions. In the forest, accuracy deteriorates because

visibility is imparied. By use of controls and comparison with accurate linear measures, sources and size of most bias and blunders can be identified. Accuracy is limited by an interaction of instrument, observer, and conditions of measurement.

31
BURKE, Doyle.

1974. Automated analysis of timber access road alternatives. USDA For. Serv. Gen. Tech. Rep. PNW-27, 40 pp.

Abstract

The evaluation of timber access road alternatives is one of the primary tasks in timber harvest planning and design. An automated system is presented using a desk-top calculator, digitizer, and plotter that analyzes a projected road location, produces the horizontal and vertical alignment values, and computes earthwork quantities. This information should be of interest to logging engineers and transportation system planners.

32
BURKHARD, Harold E.

1974. Forest management inventory: state of the art, new tools and procedures. Forest Modeling and Inventory; from the 1973 and 1974 Meeting of Midwest Mensuritionists, pp. 64-68.

Abstract

Summarizes the inventory proceeding being used by private industry in 1974 and discusses the new tools and procedures available for use in intensive forest inventory.

33
BURR, Richard D.

1976. The use of aerial photographs. U.S. Dept. of the Int., BLM. Tech. Note 287. Filing Code 9163.

Abstract

This publication deals with aerial photographs and how they can be used in the various phases of land management within the Bureau. It is intended to furnish sufficient guidelines to encourage the use of aerial photos. Emphasis has been placed on basic data in this publication for its general application to phases of Bureau activity where aerial photos can be appropriately used.

34
CANFIELD, Elmer Russell.

1969. Ecology as a means of cull estimation in standing western redcedar. Univ. of Idaho. Order Number 70-10695, 48 pp.

Abstract

Western redcedar (Thuja plicata Donn.) was studied on 41 sites in northern Idaho in a search for ecological indicators of decay. Such a search is needed to provide better understanding of the ecology of wood decay and its causal fungi as well as to develop the cull estimation methods so vitally necessary in timber and land valuation procedures.

Decay volume was 10-12 percent of the total volume (ft^3 measure) of felled and dissected trees. When volume of decay was calculated by individual logs, 15 percent of it was contained in the first two logs combined and 19 percent in the butt logs alone. The two logs contained 64 percent of the total volume in the 80-tree sample. Poria weirii (Murr.) Murr. and Polyporus sericeomollis Rom. were the most common causal fungi, occurring in 43 percent and 38 percent of the sample, respectively. P. weirii decay had a truncated cone-shaped pattern and usually was restricted to the first log. P. sericeomollis, on the other hand, extended into the second or third logs and typically occurred in a central column of decay with one or more concentric rings of decay around the column. These rings of decay were separated by regions of sound wood. Armillaria mellea (Vahl) Quel. was found in about 15 percent of the sample trees but generally was confined to the roots and lower stem and was insignificant in the decay of merchantable wood.

The effort to relate decay volume to such tree parameters as decay in an increment core, d.b.h., age, and crown length by multiple regression was unsuccessful. This prevented estimation of cull in the total sample and the relating of site and ecological factors to cull.

Fungal sporophores, wounds, fire scars, and other visible abnormalities were reliable indicators of the presence of decay when they occurred. Such indicators occurred in about half of the trees; decay in more than 90 percent of the trees without indicators was detected by increment borer.

There was some suggestion that other plants growing in cedar stands may be indicators of incidence of decay. Some significant relationships were found between the presence of a fern, Dryopteris linnaeana C. Christensen, and decay volume. Decay was 12.5 percent of the total volume when the fern was growing in the stand and 8.5 percent when it was not.

35
CARMEAN, Willard H.

1975. Forest site quality evaluation in the United States. In Advances in Agronomy, Vol. 27, pp. 209-269, [printed by Academic Press, Inc., NY.]

Abstract
Forest site quality is concerned with the ability of forest land to grow trees; thus, site quality estimation corresponds to land capability estimation for various agricultural crops. This review summarizes site quality research in the United States exclusive of Alaska and Hawaii; many Canadian publications also are listed for more complete development of certain topics. The various methods for estimating site quality are reviewed. And the history, present status, and future goals in forest site investigation are discussed.

36
CLAXTON, H. Dean, and Giuseppe Rensi.

1972. An analytical procedure to assist decision-making in a government research organization: Mathematical Model. USDA For. Serv. Res. Pap. PSW-80, 20 pp.

Abstract
An analytical procedure to help management decision-making in planning government research is described. The objectives, activities, and restrictions of a government research organization are modeled in a consistent analytical framework. Theory and methodology is drawn from economics and mathematical programing. The major analytical aspects distinguishing research from other forms of economic activities are examined. The characteristics and potential uses of a management information system are outlined.

37
COLE, Dennis M.

1977. Protecting and storing increment cores in plastic straws. Res. Note INT-216. USDA For. Serv., Ogden, UT.

Abstract
Percent shrinkage of lodgepole pine increment cores sealed in plastic drinking straws and stored for varying periods up to 21 days was compared to the method of soaking air-dried cores to restore their dimensions. Instructions are given for sealing straws with tape and recommendations made for various situations when original dimensions cannot be measured at time of core extraction.

38
COMARC Design Systems.

1977. An efficient low cost system for handling forest resource inventories. COMARC DESIGN SYSTEMS, The Agriculture Building, Embarcadero at Mission, San Francisco, CA 94105 (415-392-5268).

Abstract
A computer system for handling inventory data, mainly relating to mapping - including cover type, soils, topography, harvest and treatment areas, roads, and streams.

39
CUNIA, Tiberius. (Edited by)

1974. Proceedings: Monitoring forest environment through successive sampling. State Univ. of NY, College of Environmental Science and Forestry, Syracuse, NY.

Abstract
This volume contains all but two of the papers presented at the Symposium on "Monitoring Forest Environment Through Successive Sampling," held in Syracuse, New York, June 24-26, 1974, jointly sponsored by the IUFRO Subject Group S4.02 on Forest Resources Inventory, by the SAF Inventory Working Group, and by the SUNY College of Environmental Science and Forestry, Syracuse, New York.

40
CUNIA, T., and R. B. Chevrou.

1969. Sampling with partial replacement on three or more occasions. Forest Science, Vol 15, No. 2., June 1969, pp. 204-224.

Abstract
The theory of sampling with partial replacement is extended from two to three or more consecutive measurements of the same forest population. An illustration is given of its application to continuous forest inventory.

41
CUNIA, T.

1965. Continuous forest inventory, partial replacement of samples and multiple regression. Forest Science, Vol 11, No. 4, Dec. 1965, pp. 480-502.

Abstract
The theory of sampling populations on two occasions with partial replacement of units (SPR) is extended to use multiple regression estimates. It is shown that in general multiple are better than simple linear estimates and in many cases they are much more efficient.

Formulae are derived for (1) best estimates of current averages and changes in these averages from first to second occasion and (2) standard errors of these estimates. An example is also given of its application to a sampling design in Continuous Forest Inventory (CFI).

42
DeMARS, Donald J. and Delbert E. Thompson.

1977. Computer plotting of graphs for reports. USDA. For. Serv. Res. Note. PNW-289.

Abstract

Computer plotting can aid forest scientists and forest land managers by increasing the speed and accuracy of graph preparation. This report outlines computer data requirements for common graph types and also gives computer data requirements for special plotting techniques.

Graphs that are included are (1) the equation graph, (2) the scatter diagram, (3) the combination equation graph and scatter diagram, (4) the line graph, and (5) the histogram. Although this paper is not a user's manual for a particular machine, it should be noted that a general plotting program is available for the Wang 700B - 720C programable calculators.

43
DEMLER, L. E.

1951. Altimetry - its present-day techniques. The Journal of the American Congress on Surveying and Mapping. July-Sept. 1951. (Wallace and Tiernan - Tech. Reprint TA 1005-A-2).

Abstract

The revival of altimetry in the past decade came about just when surveyors and engineers were seeking ways of combating the high cost of field parties. Altimetry was adopted for a number of projects and produced elevations at a considerable saving in time and manpower. The adoption of new altimetry procedures, such as the leapfrog method, and the development of new instruments, such as a recorder for base stations, will no doubt advance the use of altimetry further. There are probably many surveying requirements which, if analyzed with regard to the accuracy expected in the end result of a project, would be met with altimetry and benefit from reduced field costs.

44
DRISCOLL, Richard S. and Richard E. Francis.

1975. Range inventory: Classification of plant communities. In Evaluation of ERTS-1 data for forest and rangeland surveys. USDA For. Serv. Res. Pap. PSW-112, 67 pp.

Abstract
Tests showed data gathered by the first Earth Resources Technology Satellite would be useful to managers of large forest ownerships. Forest and nonforest lands were distinguished with 90-95 percent accuracy. Forest disturbances could be detected with 90 percent accuracy when ERTS data were compared with aerial photos.

45
EDWARDS, Bruce M., Gary E. Metcalf and W. E. Frayer.

1973. Computer-produced timber management plan: An Evaluation of Program TEVAP. USDA Forest Service Research Note RM-251.

Abstract
TEVAP (Timber Evaluation And Planning), a computerized timber management planning system, was tested over a 2-year period on the Black Hills National Forest. The system's utility in the decision-making process was demonstrated for both broad and local areas.

46
EK, Alan R.

1971. A comparison of some estimators in forest sampling. Forest Service Vol. 17, No. 1, March 1971. pp. 2-13.

Abstract
The performance of a number of estimators--simple expansion, ratio, unbiased ratio, regression, and unequal probability types and stratified sampling with the simple expansion estimator--was examined in three forest tree populations using samples sizes of 4, 12, 24, and 40. Estimates were constructed for total volume, height, and crown area for these test populations. Independent variables employed were diameter, height, and crown area plus several transformations and combinations of these terms. Relative performance was evaluated using estimates of sampling variances and biases obtained from repeated sampling of the test populations. For the larger sample sizes studied, linear and parabolic regression and the Horvitz-Thompson pps estimator were usually among the best three estimators. For the smaller sample sizes, linear regression, Horvitz-Thompson pps, and ratio-of-means estimators were best. Population characteristics affecting estimator performance and implications for practical problems are discussed.

47
EK, Alan R. and J. D. Brodie.

1972. Bionomic and economic analysis of short rotation aspen management. Dept. of Forestry, 126 Russell Laboratories, University of Wisconsin, Madison, Wisconsin.

Abstract

Mathematical models were developed for stand yield for ages 2-80 for stem and branch wood, stem wood and conventional utilization standards (trees $\geq$ 5" Dbh to a 3" top diameter inside bark) for various sites and initial densities. A model of sucker density two years following harvesting of the parent stand is also presented. The yield models were subjected to conventional economic analyses and long-term simulation comparisons. Results indicate aspen rotations may be moderately shortened with substantial increases in yields if utilization standards are increased. Greatest potential lies with the best sites, but more complete utilization standards may also allow operations on sites currently considered marginal. Rotations based on the usual soil expectation value criteria could be reduced from the current 35 to 45 year range (at 5 percent discount rate) down to 20-30 years. Extremely short rotations (e.g., less than 15 years) appear undesirable due to sustained rapid volume and value growth rates well into the third decade.

48
ENSLIN, W. R., S. E. Tilman and R. Hill-Rowley

1977. A procedure for merging land cover/use data from landsat, aerial photography, and map sources: compatibility, accuracy, and cost. American Society of Photogrammetry Convention, 43rd Annual Meeting, Feb. 27 to Mar. 5, 1977. Washington, D.C., pp. 449-458.

Abstract

Regional planning agencies are currently expressing a need for detailed land cover/use information to effectively meet the requirements of various federal programs. Individual data sources have advantages and limitations in fulfilling this need, both in terms of time/cost and technological capability. A methodology has been developed to merge land cover/use data from LANDSAT, aerial photography and map sources to maximize the effective use of a variety of data sources in the provision of an integrated information system for regional analysis.

A test of the proposed inventory method is currently under way in four central Michigan townships. This test will evaluate the compatibility, accuracy and cost of the integrated method with reference to inventories developed from a single data source, and determine both the technological feasibility and analytical potential of such a system.

49
FAHNESTOCK, George R.

1970. Two keys for appraising forest fire fuels. USDA Forest Serv. Res. Pap. PNW-99, 26 pp.

Abstract
A glossary proposes nontechnical definitions of fuel characteristics that significantly affect forest fire behavior. One dichotomous key uses the terminology to determine the relative rate of fire spread; the other key ranks probability of crown fire occurrence. The keys in themselves are not a fuel appraisal system but as an adjunct should be helpful in training, inventory, and interdisciplinary understanding of fuels.

50
FARMER, Eugene E., Ray W. Brown, Bland Z. Richardson, and Paul E. Packer.

1974. Revegetation research on the Decker coal mine in southeastern Montana. USDA For. Serv. Res. Pap. INT-162, 12 pp.

Abstract
First-year results of revegetation research at the Decker coal mine in southeastern Montana are described. Three types of main plots were located on overburden material. Treatments included different grass mixtures, fertilizer, and mulch on irrigated and unirrigated plots. On the basis of dry-weight grass production, several treatments produced acceptable first-year grass stands. The top-dressing of mine overburden appears to be a highly desirable revegetation practice.

51
FFOLLIOTT, Peter F. and David P. Worley.

1965. An inventory system for multiple use evaluations. U.S. For. Serv. Res. Pap. RM-17, 15 pp.

Abstract
Describes a multiple BAF (basal area factor) inventory system flexible enough to describe a forested tract so multiple use interpretations can be made from known relations of product yields to the inventory description of the resources on the tract. Basal area was selected as the inventory basis because it is (1) easily determined in the field; (2) easily converted to other expressions; and (3) many multiple use relations have already been developed with basal area as the independent variable. A multiple BAF system is a point-sampling system that uses several basal area factors to describe the stocking of trees. Its use is illustrated by hypothesizing forest management methods for a pilot watershed in Arizona.

52
FFOLLIOTT, Peter F. and David P. Worley.

1973. Forest stocking equations: their development and application. USDA For. Serv. Res. Pap. RM-102. 8 pp.

Abstract

Using point-sampling techniques, stocking conditions at a sample point can be described in terms of whether or not the point is stocked to a minimum basal area level corresponding to a particular basal area factor (BAF). Stocking equations relating proportions of a forest stocked to minimum basal area levels corresponding to each BAF used in an inventory can be defined by regression analyses. Stocking equations can be used to help evaluate land treatment potential, determine treatment feasibility on a single management unit, and as a basis for setting operating priorities on a number of management units.

53
FOOD & AGRICULTURE ORGANIZATION OF THE UNITED NATIONS.

1973. Manual of forest inventory. Text book.

Abstract

A how-to extensive inventory, that lists and briefly describes the main tools which are used in forest inventory, and gives advise on their use.

54
FOWLER, Gary W. and William G. O'Regan.

1974. One-sided truncated sequential t-test: application to natural resource sampling. USDA Forest Serv. Res. Paper PSW-100, 17 pp.

Abstract

A new procedure for constructing one-sided truncated sequential t-tests and its application to natural resource sampling are described. Monte Carlo procedures were used to develop a series of one-sided truncated sequential t-tests and the associated approximations to the operating characteristic and average sample number functions. Different truncation points and decision boundary patterns were examined. The fixed sample size t-test and Barnard's open one-sided sequential t-test were compared with the new procedure. The upper one-sided test described can easily be modified to a lower one-sided test.

55
FRAYER, W. E., George B. Hartman and David R. Bower.

1974. Inventory design & analysis. Proceedings of a workshop sponsored by the inventory working group, Society of American Foresters. Society of American Foresters, 1010 Sixteenth St., N.W. Washington, D. C. 20036.

Abstract

A summary of the proceedings of the workshop held in 1974. Covers everything from setting objectives of the manager, through the different inventories used to meet these objectives. Covers, in detail, different inventory methods and "pro's and con's" of each.

56
FRAYER, Warren E. and George M. Furnival.

1967. Area change estimates from sampling with partial replacement. Forest Science, Volume 13, #1, March 1967.

Abstract

Presented is a method of calculating changes in area attributes on remeasured plots. Methods are shown whereby the estimates of change can be applied to results of a previous inventory and combined with the results of a current inventory to form final estimates of current parameters. An example is shown based on data taken from the most recent forest survey of Vermont.

57
FRAYER, Warren E.

1966. Weighted regression in successive forest inventories. Forest Science, Volume 12, #4, December 1966.

Abstract

The main objective of this study was to conduct a rigorous analysis of available data to test the validity of updating timber volume estimates by means of least-squares regression. The data were tested to determine if the updating model developed by Ware (1960) violates any of the assumptions of least-squares regression; namely, independence, normality, and homogeneous variance of regression residuals, as well as freedom from error in the independent variables. Analysis indicated that all assumptions were justified except homogeneity of the variance. It was found that weighted regression--employing a function of the expected current volume as a weight--stabilized the variance. In general, unweighted regression underestimated the variance of a volume predicted for a date later than the year of remeasurement. The results also suggest widespread applicability of the weighting procedure for estimating variances efficiently.

58
GENT, H.

1974. Measurement methods in Finnish forestry. Forestry and Home Grown Timber (1974) 3(3)31-32 [En]. [Forestry Abstracts 1974 Vol. 35 No. 12.]

Abstract
In Finland, standing volume is estimated before harvesting and without felling sample trees. The stand is first divided into populations and smaller areas called harvesting compartments and cutters' strips, and volume (unbarked, solid cu. m) is calculated by a centralized data-processing computer. A new method for measuring felled pulpwood is also described. The author discusses possible applications of the Finnish system to UK conditions.

59
GETTER, James R. and Tom H. Creighton.

1977. Forest site index mapping and field model inputs to determine potential site productivity. Resource Inventory Notes, BLM 7, Sept. 1977. USDI, BLM, D-340, Denver Service Center, Denver Federal Center, Bldg. 50, Denver, CO 80225.

Abstract
This report describes the initial steps, data sources, results, and conclusions from a prototype computer system to overlay multivariate map and remote sensing data to estimate forest site productivity.

60
GREEN, Alan W.

1976. Assessing the timber resource situation on a working circle using inventory data. USDA For. Serv. Res. Pap. INT-183, 43 pp.

Abstract
Realistic projections of timber supplies require knowledge about the land's wood-growing capacity, constraints on the use of forest land for timber production, and the extent and condition of the existing timber resource. Timber inventory data can be used to estimate potential available output and to assess the existing resource in terms of general management needs and of its performance in producing usable wood.

61
GRIGG, David.

The logic of regional systems. Annals Assoc. Amer. Geog., V. 55, No. 3, pp. 465-491.

Abstract
It is argued in this paper that regionalization is a similar process to classification. The terminology and procedures of the two are compared and it is concluded that there is a close similarity except that there is no direct analogy in regionalization with the individual of classification. It is suggested that operationally defined individuals partially overcome this problem. The histories of ideas about the nature and purpose of regional systems and classification systems are briefly compared and again found to be similar. Ten principles of classification derived from the work of logicians and taxonomists are then stated and the methods of constructing regional systems are examined in the light of these principles. It is shown that most of the points revealed by such an examination have been previously discussed by geographers, although they are arguing from different premises. Some of the principles, however, do raise problems which have hitherto received little attention.

62
GROSENBAUGH, L. R.

1974. STX 3-3-73: tree content and value estimation using various sample designs, dendrometry methods, and V-S-L conversion coefficients. USDA Forest Serv. Res. Paper SE-117, 112 pp.

Abstract
Describes comprehensive Fortran computer program that handles trees selected individually or in clusters by means of constant or varying probabilities in single-stage or multi-stage sample designs using photos, strips, plots, lines, points, lists, 3P, or combinations of these. Dendrometry may be nominal (D.B.H only) or at several points along the stem. Summary of primary units (U.S. or metric units of volume, surface, length) by quality-defect class can be program-converted to related quantities of interest (product, value, etc.).

63
HAACK, Paul M.

1964. Compilation of tree measurement data by hand or computer. USDA Forest Serv., Northern Forest Exp. Stn., Juneau, Alaska. 17 pp.

Abstract
Presenting ways to improve and speed up the task of compiling tree measurement data for research and administrative purposes.

64
HAGBERG, Erik.

The new Swedish national forest survey. Department of Forest Survey, Forest Research Institute of Sweden.

Abstract
This information includes data concerning the size and composition of the growing stock, the rate of growth--from the new type of inventory started in 1953--also the present drain. In addition, the survey gives a land classification including a detailed description of the forest area.

65
HAMILTON, David A., Jr.

1974. Event probabilities estimated by regression, USDA Forest Service Res. Pap. INT-152, 18 pp.

Abstract
Describes an algorithm for fitting the relationship between a dichotomous dependent variable and a number of independent variables. The specific functional form utilized is the logistic function. The algorithm, proposed and programed by Walker and Duncan (1967), has been generalized by adding a subroutine to handle data transformations and by introducing procedures to handle data sampled with unequal probability. A user's guide discusses makeup of program control cards, data transformation capabilities, program output, and program-generated errors.

66
HAMILTON, David A., Jr., and Donna L. R. Wendt.

1975. SCREEN: a computer program to identify predictors of dichotomous dependent variables. USDA For. Serv. Gen. Tech. Rep. INT-22, 20 pp.

Abstract
The algorithm reported here is a modeling tool that screens potential relationships between a set of independent variables and a dichotomous dependent variable. Uses of the algorithm and its properties are discussed. A user's guide explains the preparation of input cards for the two PL/1 procedures and explains the program output.

67
HAMILTON, David A., Jr., and Bruce M. Edwards.

1976. Modeling the probability of individual tree mortality. USDA For. Serv. Res. Pap. INT-185, 22 pp.

Abstract
This paper describes procedures for developing and testing models that predict the probability of individual tree mortality. The modeling procedures include data screening, parameter estimation, and model verification techniques that have been designed to deal with dichotomous dependent variables. To demonstrate the procedures, mortality models for 10 north Idaho species are developed and verified.

68 HAMNER, Larry N.

1975. WRAP: A multiple resource model for allocation of wildland resources. Tennessee Valley Authority Tech. Note B-12, Norris, TN.

Summary
This program takes a multiple use approach to the allocation of forest resources on small tracts.

69
HANLEY, Donald P.

1976. Tree biomass and productivity estimated for three habitat types of northern Idaho. University of Idaho Forest, Wildlife and Range Experiment Station Bulletin No. 14.

Abstract
Tree biomass and potential productivity were estimated for three northern Idaho habitat types, Abies grandis/Pachistima myrsinites, Thula plicata/Pachistima myrsinites, and Tsuga heterophylla/Pachistima myrsinites. Twelve unmanaged mature stands were analyzed using inventory records over an 11-15 year period. Foliage, branchwood, peeled bole, bark, and root weights were estimated for each tree using regression equations developed by numerous researchers. Productivity was measured by assessing the change in biomass during the measurement period. Biomass averaged 491.7 M kg/hectare, while periodic productivity averaged 13.4 M kg/hectare/year. The estimates were within the published range of measured values for similar forest types.

70
HARDING, Roger.

1977. Western Washington forest inventory. Pixel Facts, Vol. 7, March '77, Department of Natural Resources, Olympia, WA.

Abstract
Covers procedures for inventory in western Washington. Mainly concerned with resource data banks and aerial photography.

71
HARDING, Roger A.

1974. Grid works for DNR. DNR Report #25, State of Washington, Department of Natural Resources.

Abstract
GRIDS (Gridded Resource Inventory Data System) is basically a one-acre sample of each ten acres of land managed by the Department of Natural Resources throughout the State of Washington--300,000 (sample) data points for 3,000,000 acres. The large array of data collected on these sample points comes from aerial photographs, maps, field measurements, field activities or any valid source. This data is coded and stored on electronic data processing files for quick retrieval in a variety of listings and computer printout maps.

Changes to the data are made quickly and easily, thereby allowing for up-to-date, accurate information on the variety of Department-managed lands upon which the resources are changed by a multitude of activities. GRIDS has been in full operation since the spring of 1972.

72
HAZARD, John W. and Lawrence C. Promnitz.

1974. Design of successive forest inventories: optimization by convex mathematical programing. Forest Science, Vol. 20, No. 2, June 1974, pp. 117-127.

Abstract
Convex mathematical programing is proposed as a method of optimally allocating forest inventory sampling resources under different sampling plans to meet specified precision requirements on several variables. Results of a sensitivity analysis under sampling with partial replacement shows the response of the solution to changing inputs when each restriction becomes limiting. The solutions illustrate that the optimum replacement fraction can vary from complete remeasurement to large replacement fractions depending upon the specified precision levels, the population parameters, and the relative costs of obtaining information.

73
HAZARD, John W.

1974. Optimization in multi-resource inventories. IN Inventory Design and Analysis. Proc., Workshop Sponsored by the Inventory Working Group, Soc. of American Foresters; Colo. State Univ., pp. 170-177. July 23-25, 1974 [Society of American Foresters, 1010 16th St., Washington, D.C.]

Abstract
The optimum allocation of effort in multi-resource inventories is discussed. Some applications of optimization techniques are reviewed.

74
HAZARD, John W. and Larry E. Stewart.

1974. Planning and processing multistage samples with a computer program. USDA For. Ser. Tech. Rep. PNW-11.

Abstract
A computer program was written to handle multistage sampling designs in insect populations. It is, however, general enough to be used for any population where the number of stages does not exceed three. The program handles three types of sampling situations, all of which assume equal probability sampling. Option 1 takes estimates of sample variances, costs, and either a specified cost or precision and computes the optimum number of sampling units to select prior to sampling. Option 2 takes the observations, continuous or discrete, from a pilot survey or actual inventory and estimates the mean and variances. It then computes an estimate of the optimum number of units which should have been taken. Option 3 is a special case of the situation in Option 2 where some of the observations are lost or for some other reason an unequal number of subunits per primary unit exists.
An explanation of multistage sampling and a processed example are included.

75
HEINSDIJK, D.

1975. Forest assessment. Pudoc, Wageningen, Netherlands. Centre for Agricultural Publishing and Documentation, Wagening. 359 pp.

Abstract
Forest assessment is the evaluation of forest lands and stands, and their general management, taking into account all uses to which they are put. For such assessment, one must consider history, topography, climate, soil, production, economics of timber, ecology and nature conservation, and social functions including recreation. The treatment of these subjects mentions present trends, and describes temperate, subtropical and tropical circumstances.

76
HELLER, Robert C. (technical coordinator).

1975. Evaluation of ERTS-1 data for forest and rangeland surveys. USDA Forest Serv. Res. Paper PSW-112, 67 pp.

Abstract

Tests used data gathered by the first Earth Resources Technology Satellite. Results on sites in Georgia, Colorado, and South Dakota indicated that ERTS enlargements, preferably color, would be useful to forest managers of large ownerships for broad area planning. Forest land was distinguished from nonforested land with 90 to 95 percent accuracy, in both photointerpretation and computer-assisted analysis. Further breakdowns of cover types could not be made with acceptable accuracy by either method. Forest disturbances from natural causes or human activity could be detected with 90 percent accuracy when ERTS imagery was compared with 6-year-old aerial photos. Stress from mountain pine beetle could not be detected; ERTS wavebands are too broad to identify dying foliage.

77
HENDEE, John C., Roger N. Clark, Mack L. Hogans, Dan Wood and Russell W. Koch.

1976. Code-A-Site: A system for inventory of dispersed recreational sites in roaded areas, back country, and wilderness. USDA For. Serv. Res. Pap. PNW-209, 33 pp.

Abstract

Code-A-Site is a system for inventorying dispersed recreation sites that are established by users along forest roads, in back country, or in wilderness. The system uses edge-punch cards and needle-sorting methods for recording, storing, and retrieving basic site information such as location, characteristics, available resources, activities, and impacts.

78
HENNES, LeRoy C., Michael J. Irving and Daniel I. Navon.

1971. Forest control and regulation . . . a comparison of traditional methods and alternatives. USDA Forest Service Research Note PSW-231.

Abstract

Two traditional techniques of forest control and regulation--formulas and area-volume check--are compared to linear programing, as used in a new computerized planning system called Timber Resource Allocation Method (Timber RAM). Inventory data from a National Forest in California illustrate how each technique is used. The traditional methods are simpler to apply and less expensive, but Timber RAM allows a more realistic definition of timber resources and can analyze a wider spectrum of forest management practices.

79
HERMAN, Francis R., Donald J. Demars and Robert F. Woollard.

1975. Field and computer techniques for stem analysis of coniferous forest trees. USDA For. Serv. Res. Pap. PNW-194, 51 pp.

Abstract
Presents step-by-step instructions for stem analysis field and computer techniques which are adaptable to trees up to 800 years old. Stem profiles, height-age graphs, cards, and data lists are produced by the computer for any conifer for which growth information is to be analyzed.

80
HILDEBRAND, G.

1976. Remote sensing in forestry. Proceedings of the Symposium held during the XVIth IUFRO World Congress. Oslo, Norway. Text book.

Abstract
The text covers the entire area of remote sensing including: Interpretation, spaceborne radar, computer-aided analysis, mapping, acreage estimation, remote sensing of tropical forest, with special emphasis on imagery application in forestry.

81
HILDEBRANDT, G. (Edited by)

1973. Proceedings Symposium. International Union of Forest Research Organizations, Subject Group Remote Sensing, including aerial photography. S 6.05, Freiburg, 1973. Printed 1974 Abteilung Luftbildmessung und Luftbild Interpretation der Universitat.

Abstract
Summary of the proceedings of the above. Main topics are: Photo interpretation in tropical forests, application of photo interpretation in environmental research, forest - and land use - inventory forest. Mensuration by photo interpretation, forest mapping and photogrammetry, interpretation of spaceborne imagery, approaches of automated and digitized evaluation of aerial photography, problems of organization in national and international remote sensing programs.

82
HOFFMAN, George R. and Robert R. Alexander.

1976. Forest vegetation of the Bighorn Mountains, Wyoming: A habitat type classification. USDA For. Serv. Res. Pap. RM-170, 38 pp.

Abstract

A vegetation classification based on concepts and methods developed by Daubenmire was used to identify 14 habitat types and related phases in the Bighorn Mountains of north-central Wyoming. Included were five habitat types in the Pinus ponderosa series, three in the Abies lasiocarpa series, two each in the Pseudotsuga menziesii and Pinus contorta series, and one each in the Populus tremuloides and Picea engelmannii series. A key to identify the habitat types and the management implications associated with them are provided.

83
JANSEN, Henricus C.

1976. Range RAM . . . a long-term planning method for managing grazing lands. USDA Forest Serv. Res. Paper PSW-120, 15 pp.

Abstract

Range RAM (Resource Allocation Method) is a computerized planning method designed to assist range managers in developing and selecting alternatives in spatial and temporal allocation of resources. The technique is applicable at the forest or district management levels, or their equivalents. Range RAM can help formulate plans that maximize the cost of management while meeting a variety of constraints on range productivity, budget level, and economic returns. Constraints are specified by expected budget levels and aggregate output targets. Information needed to use Range RAM includes estimates of production, receipts, and management costs associated with proposed actions.

84
JENSEN, Chester E.

1973. MATCHACURVE-3: multiple-component and multidimensional mathematical models for natural resource studies. USDA For. Serv. Res. Pap. INT-146, 42 pp.

Abstract

Mathematical model development procedures for graphed relations between variables are presented. As an extension of single-component two-dimensional model alternatives given in the two previous papers of the Matchacurve series, the author concentrates on multiple-component and multidimensional modeling. These procedures are particularly useful in describing unique main effects and interactions. A detailed application is given for a heavily convolute surface developed from "live" data.

85
JENSEN, Mark S. and Merle P. Meyer.

1976. A remote sensing application program and operational handbook for the Minnesota Dept. of Natural Resources and other state agencies. Remote Sensing Lab., College of Forestry, University of Minnesota, St. Paul, Minnesota.

Abstract
Report concerns results of a multi-study program to determine the practical capability of remote sensing techniques as a means to provide efficient (practical), cost-effective solutions to the resource data needs of Minnesota's resource management agencies.

86
JOHNSON, Evert W.

1972. Basic 3-P sampling. Agricultural Experiment Station, Auburn University, For. Dep. Ser. 5, 12 pp.

Abstract
Paper explains and encourages the use of the 3-P sampling method.

87
JONES, John R.

1969. Review and comparison of site evaluation methods. USDA Forest Service Research Paper RM-51, 27 pp.

Abstract
Both the productivity of sites and their characterization for silvicultural purposes are considered. The review covers site index; classification of vegetation site types and physiographic site-types; soil-site equations; classification and mapping of forest soils as done in the United States and Germany; and the ordination of vegetation and of physical environments into gradients representing moisture, temperature, and nutrient regimes. Advantages and limitations of the methods are discussed, and a sequence is suggested for regional site research programs.

88
KEMPTHORNE, et al. (Editor).

1954. Statistics and mathematics in biology. Text book.

Abstract
Chapters 18 and 19 discuss forest inventory. Dorn, Harold F., Chapter 18, Problems in Forest Inventory: From the Forester's Point of View. Hagel, Austin A., Chapter 19, Problems in Forest Inventory: From the Statistical Point of View.

A general review, information is old, data given in more recent text would be more useful.

89
KESSELL, Stephen R.

1974. Wildland inventories and fire modeling by gradient analysis in Glacier National Park. Tall Timber Fire Ecology Conference and Fire and Land Management Symposium Meeting at Univ. of Montana, Missoula, MT. Published by Tall Timber Research Stn., Bull. 14, pp. 115-162, Tallahassee, FL.

Abstract
Shows the Glacier N.P. fire modeling scheme. The article describes: (1) a simple step-by-step example of the development and use of a gradient model for a hypothetical forest ecosystem, and (2) a documental description of the Glacier National Park model as it relates to fire management, including description of fuel loadings and spatial distributions, and the effects of the latter on stochastic elements of fire spread modeling.

90
KESSELL, Stephen R.

1977. Gradient Modeling: A New Approach to Fire Modeling and Resource Management. Ecosystem Modeling in Theory and Practice (text), pp. 576-603.

Abstract
Gradient modeling is a computer-based resource modeling system designed in Glacier National Park to meet the needs for a resource-information system, a resource inventory, and a fire-modeling package. It provides these capabilities by linking four major components:

1. A terrestrial resource inventory system
2. Gradient models of the vegetation and flammable fuel
3. Weather and micrometeorology models
4. Fire behavior models

Its unique linkage of these components provides modeling capabilities unavailable from any other resource management system.

Gradient modeling is an application of the techniques of gradient analysis and ordination (rather than habitat classification) to resource modeling. It builds on the wide theoretical and analytical base of gradient analysis developed over the past two decades by Whittaker, a group at the University of Wisconsin lead by Bray and Curtis, and many others. Rather than dealing with the landscape and its vegetation as sharp, discontinuous units, gradient analysis describes and quantifies continuous variation in the landscape and its biota that corresponds to various spatial and temporal environmental gradients.

91
KUCHLER, A. W.

1973. Problems in classifying and mapping vegetation for ecological regionalization. Ecology, Vol. 54, No. 3, pp. 512-523. Late Spring 1973.

Abstract

Important research carried on currently in ecological regionalization calls for a close look at the role of classifying and mapping vegetation, as both these activities can be of fundamental significance in regionalization. A correlation of classifying and mapping vegetation with ecological regions requires an analysis of vegetation, classifications, regions, and maps.

The analysis of vegetation revealed the character of biogeocenoses, plant communities, and continua and, incidentally, made it clear that the correct term for the science of vegetation studies is phylocenology. Problems of vegetation boundaries can develop when continua are compared with transitions. This is important in mapping, where the nature and location of boundaries is of major significance. Vegetation is best dividied into natural and cultural vegetation and further subdivided on the basis of (1) physiognomy and structure, (2) floristics, (3) community dynamism, and (4) community relations with their respective biotopes.

When these units were applied to an analysis of classifications, it developed that a basic distinction must be made between highly flexible, purely descriptive and essentially classless approaches on the one hand, and clearly organized hierarchies on the other. Serious difficulties can arise when a detailed description of vegetation is related with a classification, and an important distinction emerging from these findings is between worldwide and regional classifications. Multiple mapping at large scales evolved into a particularly useful and enlightening method.

However, the often demonstrated correlation between phylocenoses and environmental conditions must not lead a researcher to falsely optimistic conclusions, as it may not be applicable in the humid tropics. Aubreville, Poore, Wyatt-Smith, Koriba, Kuchler & Sawyer, etc., have illustrated the need for caution in interpreting such correlations.

An analysis of some aspects of regions demonstrated that the relationships between vegetation types and biotopes must be clarified before meaningful ecological regions can be established. This need was illustrated with the map and inset maps of the Hunter Valley region in New South Wales, which proved most revealing.

The chief problem of maps in ecological regionalization was found to be the map scale. Scale problems can usually be solved without much difficulty, but they must be clearly understood if the results are not to be misleading.

The very nature of the biogeocenose implies by definition that the geographical distributions of biocenoses and of biotopes are most intimately related. The various analyses revealed that vegetation may be regarded as a tangible, integrated expression of the biogeocenose. Maps showing the geographical distribution of the natural (or the potential natural) vegetation do therefore and thereby also reveal ecological regions.

92
LaBAU, Vernon J.

1967. Literature on the Bitterlich method of forest cruising. USFS Research Paper PNW-47.

Abstract
A bibliography.

93
LANGLEY, Philip G.

1969. New multi-stage sampling techniques using space and aircraft imagery for forest inventory. Proc. Sixth Int. Symp. on Remote Sensing of Environment. Univ. Mich., Ann Arbor, MI. 1969:pp 1179-1192.

Abstract
A new multi-stage sampling technique, with wide application in earth resource surveys using remote sensing, has been developed and tested on several occasions. For the first time, a complete theory is available with the capability of utilizing information from sample imagery of increasingly finer resolution simultaneously. First-stage samples are selected at random from space or aircraft imagery with probability proportional to a prior prediction as to the relative

resource quantity contained in the population units. Increasingly higher resolution imagery is obtained on subsamples within subsequent stages, again with probability proportional to the prediction made at the appropriate stage. Finally, sampling is undertaken on the ground to obtain the necessary ground-truth data. These ground measurements are expanded through the system to obtain estimates that are valid over the entire area of interest. The method has been proven to yield unbiased estimates, and furthermore the sampling error depends solely on the accuracy of the predictions made at each stage. Consequently, the estimates are free of the sampling errors customarily arising by virtue of the inherent variation existing between the raw population units. Allocation formulas have been developed for optimally allocating survey funds to minimize the sampling error for a given fixed cost of the survey.

94
LARSON, Robert W. and Marcus H. Goforth.

1970. TRAS - A computer program for the projection of timber volume. USDA Forest Service, Agriculture Handbook No. 377.

Abstract
The handbook gives the program description, preparation of input, and sample problems.

95
LEARY, Rolfe A.

1976. Interaction geometry: an ecological perspective. USDA For. Serv. Gen. Tech. Rep. NC-22, 8 pp.

Abstract
A new mathematical coordinate system results from a unique combination of two frameworks--the phase plane and coaction cross-tabulation. It may be used for analysis and synthesis.

96
LINDSEY, Alton A.

1958. Field efficiencies of forest sampling methods. Ecology. July 1958, Vol. 39, No. 3., pp. 428-444.

Abstract
The Bitterlich methods was shown to be more effecient in sampling density and basal area. Seven methods were compared, including variating the following: square, strip, circle and quarter.

97
LOETSCH, F., and K. E. Haller (text) (English by E. F. Briinig).

1973. Forest inventory - Volume 1. 434 pp. BLV Verlagsgesellschaft, Munich, Germany.

Abstract
The text is actually a handbook on the theoretical background and practice of modern forest inventory. It includes statistics of forest inventory and use of aerial photographs. It is a very complete and high level manual.

98
LOETSCH, F, F. Zohrer, and K. E. Haller (English by K. F. Panzer).

1973. Forest Inventory, Volume 2, 469 pp. BLV Verlagsgesellschaft, Munich, Germany.

Abstract
This is the second volume of a two-volume textbook on Forest Inventory. It combines many of the heterogeneous elements as statistics, photo interpretation, forest mensuration and electronic data processing under the aspect of forest inventory methodology.

99
LUND, H. Gyde.

1974. So we know what we have--but where is it? Proc: Monitoring The Forest Environment Through Successive Sampling, SUNY, Syracuse, NY, pp. 133-141.

Abstract
The Bureau of Land Management is currently using a double sampling scheme in its extensive forest inventories of the national resource lands. The first sample comes from photo interpretation. Photo points are permanently marked on the photos and USGS quad maps. The interpreted information is stored on magnetic tape along with the universal transverse mercator coordinates of each point. Heretofore the only use we have made of the photo file is to provide a sampling frame for field observations (approximately one out of every ten photo points become a field plot).

This paper describes the regression procedures we are investigating to relate field information back to the photo file.

100
LUND, Hy Gyde, Vernon J. LaBau, Peter F. Ffolliott, and David W. Robinson.

1978. Integrated inventories of renewable natural resources: proceedings of the workshop. USDA For. Serv. Gen. Tech. Rep. RM-55, 482 pp.

Abstract
The proceedings of the workshop containing over 70 papers on resource information needs, present inventory methodology, land classification systems, remote sensing, design considerations, data processing and information retrieved systems and state-of-the-arts papers on multiple resource inventories.

101
LUND, H. Gyde and Matt Kniesel, Jr.

1975. Multiple resource inventory system. Proc: Systems Analysis and Forest Resource Management, Univ. of Georgia, Athens, GA, pp. 433-441.

Abstract
In a trial study in Colorado, the Bureau of Land Management successfully incorporated a combination wildlife, range, and watershed survey into its extensive forest inventory program. Photo points, interpreted during the forest inventory, were restratified on wildlife and range criteria. These points were sub-sampled with field plots and estimates of herbage production, ground cover types, erosion condition classes, and deer-days use were obtained. Area statistics were generated, and field prediction equations were developed. The cost of this multiple-resource inventory system was comparable to the cost of other survey methods currently being used by the Bureau.

102
LUNDGREN, Allen L.

1973. Cost-price: a useful way to evaluate timber growing alternatives. USDA For. Serv. Res. Pap. NC-95, 16 pp.

Abstract
This paper explains how to calculate and use cost-price as an investment criterion for timber and other forest products. Cost-price is the cost (including a return on invested capital) of producing a unit of output, usually expressed as dollars per cubic foot or other unit of output.

103
MacLEAN, Colin D.

1972. Photo stratification improves Northwest timber volume estimates. USDA Forest Serv. Res. Pap. PNW-150, 10 pp.

Abstract
A recent test of forest survey data from the State of Washington showed double sampling for stratification to be about twice as efficient as simple field sampling as a means of estimating timber volume. Optimum allocation of field plots was only slightly more efficient than proportional allocation.

104
MacLEAN, Colin D. and Charles L. Bolsinger.

1973. Estimating productivity on sites with a low stocking capacity. USDA Forest Service Res. Pap. PNW-152, 18 pp.

Abstract
In the arid West, many sites cannot support normal yield table stocking levels. Consequently, timber yields may be overestimated and stocking underestimated.

Two methods are proposed for discounting normal yield tables for limited stocking capacity: one based on habitat types and the other on identification of certain indicator plants and other variables.

105
MARSHALL, John A., and Glenn H. Deischman.

1976. Computerization of data handling for long-term forest research plots. Northwest Science, Vol. 50, No. 4, pp. 231-235.

Abstract
Tree and stand development data from long-term research sample plots in northern Idaho have never been utilized as fully and effectively as they might have been because of time required to select, check, and arrange all appropriate portions for analysis. This report describes development of automated data processing procedures that make access to desired data easy and inexpensive and also provide editing capabilities, improved insurance against data loss, and printed field forms keyed to each plot for recording the next remeasurement.

106
MASON, Richard R.

1977. Sampling low density populations of the Douglas-fir tussock moth by frequency of occurrence in the lower tree crown. USDA For. Serv. Res. Pap. PNW-216, 8 pp.

Abstract
A new method is describe for rapidly estimating the larval density of low-level populations. Densities of 1.0 or fewer larvae per 1,000 sq in (0.64 sq m) of branch area in the midcrown of host trees can be predicted from the proportion of sample units that are infested in the lower tree crown. This procedure is an improvement over the conventional midcrown sampling method because observations can be made in the more accessible lower crown without clipping and measuring branches. The technique is especially applicable to low-level populations which require the examination of large amounts of foilage to estimate larval density.

107
MASON, Bruce and Girard.

1976. Review of the Bureau of Land Management, Medford, Oregon District, Josephine master unit. Timber productivity capability classification. Prepared for the O & C Counties Association.

Abstract
Includes an evalutation of the BLM's Timber Productivity Capability Classification as pertaining to the Medford, Oregon District. Evaluation of the criteria used to distinguish between the various land capability classifications are included.

The study was authorized by the O & C Counties Association because of the direct effect the Timber Production Capability Classification (TPCC) Timber Production Base lands will have on the allowable cut of the Master Unit.

108
MAWSON, Joseph C.

1976. A tree inventory system. Univ. of Massachusetts.

Abstract
A computer program for giving volumes.

109
MAXWELL, Wayne G., Franklin R. Ward.

1976. Photo series for quantifying forest residues in the Ponderosa pine type, Ponderosa pine and associated species type, lodgepole pine type. USDA For. Serv. Gen. Tech. Rep. PNW-52.

Abstract
Six series of photographs display different forest residue loading levels, by size classes, for areas of like timber type and cutting practice. Information with each photo includes measured weights, volumes and other residue data, information about the timber stand and harvest or thinning actions, and fuel ratings. These photo series provide a fast and easy-to-use means for quantifying and describing existing and expected residues.

110
MAYER, Dr. Hanner.

1971. Development trends in the silviculture of mountain forests. Institute for Silviculture, Vienna, Austria.

Abstract
This paper treats questions of silviculture and forest utilization and fundamental aspects of future development in the management of mountain forest in the Alpine region.

111
McCORMACK, R. J.

1970. The Canada land inventory. The Canada Land Inv. Rep. No. 1, Dept. of Reg. Economic Expansion, Ottawa.

Abstract
The publication describes areas covered by the Canada Land Inventory, technical background, what the inventory provides, recent history, and its objective and scope.

112
McCORMACK, R. J.

1970. The Canadian land inventory - land capability classification classification for forestry. Report No. 4. Dept. of Regional Economic Expansion, Ottawa.

Abstract
This publication describes the Canada land inventory, land classification system, basis of classification, capability classes, and guidelines for mapping.

113
METEER, James W.

1965. A conference on continuous forest inventory. Proceedings of the conference on continuous forest inventory. Michigan Technological Univ., Houghton, MI.

Abstract
Topics of the conference include: principles and planning, programs and machine work, sampling, soil-site analysis, and policy and forest control. Each topic is covered by several different papers from individual authors.

114
MEYER, Merle P., and James R. Marshall.

1977. Specifications for improvement of tonal contrast quality in B&W summer infrared forest aerial photography. Minnesota For. Res. Notes., No. 263, January.

Abstract
The recent shift to low contrast negatives, electronically dodged and printed, has seriously impaired tonal quality of medium-scale Lake States B&W infrared forest aerial photography. Comparisons of various combinations of camera filter/film exposure-development/paper contrast grade showed that a Zeiss C filter/underexposed-overdeveloped film/medium contrast grade paper print combination provided significant improvement in tonal quality.

115
MEYER, Arthur H. and Forrest B. Nelson.

1952. Accuracy of forest growth determination based on the measurement of increment cores. Bulletin 547, Pennsysvania Agricultural Exp. Stn., The Pennsylvania State College, State College, Pennsylvania.

Abstract
Looks into the accuracy of predictions made from increment bores.

116
MOSER, John W.

1976. Proceedings resource data management symposium sponsored by Society of American Foresters, Systems Analysis Working Group and Inventory Working Group. Cooperative Extension Service, Purdue Univ., West LaFayette, IN.

Abstract
Topics discussed in the review are: the use and importance of information in managerial decision making, illustrations of

generalized data base management systems and geographical information systems, and example of both public agency and private industry utilization of these systems.

117
MOSER, John W.

1972. Purdue forest data processing service program documentaion. Res. Bull. 891, Purdue Univ., Agri. Exp. Stn., West Lafayette, IN.

Abstract
The objectives of the system are (1) to implement the inventory methods described in Purdue Agricultural Experiment Station Research Bulletin No. 786 (Beers and Miller, 1964) and the inventory methods in use by the State service foresters, (2) to calculate growth estimates from predicted changes in the present stand structure as determined from the inventory summarization and (3) to provide Indiana landowners with a list of primary wood-using industries in the vicinity of their inventoried woodlands.

118
MOSER, John W.

1970. A forest data processing service for Indiana landowners. Res. Bull. No. 864, Purdue Univ., Agri. Exp. Stn., Lafayette, IN.

Abstract
In cooperation with the Indiana Department of Natural Resources, the Purdue University Department of Forestry has developed a Forest Data Processing Service that (1) implements the inventory methods Described in Purdue Agricultural Experiment Station Research Bulletin No. 786 and the inventory methods in use by the state service foresters, (2) calculates growth estimates from predicted changes in the present stand structure and (3) provides a list of primary wood-using industries in the vicinity of the inventoried woodland. The description and utilization of the processing system are described in this bulletin.

119
MURTHA, P. A.

1969. Aerial photographic interpretation of forest damage. An annotated bibliography. For. Management Institute, Ottawa, Ontario, Information Report FMR-X-16.

Abstract
The purpose of this annotated bibliography is to place under one cover as many pertinent references as possible that deal with a photo interpretation of forest damage.

120
MYERS, Clifford A.

1977. A computer program for variable density yield tables for loblolly pine plantations. USDA For. Serv. Gen. Tech. Rep. SO-11, 31 pp.

Abstract
The computer program described here uses relationships developed from research on loblolly pine growth to predict volumes and yields of planted stands, over the site range of the species, under a wide range of management alternatives. Timing and severity of thinnings, length of rotation, and type of harvest can be modified to compare the effects of various management strategies on wood yield. The program can be modified readily for other conditions or species.

121
MYERS, Clifford A.

1970. Computer-assisted timber inventory analysis and management planning. USDA For. Serv. Res. Pap. RM-63, 53 pp.

Abstract
Presents computer programs, written in Fortran IV, for analysis of inventory data, computation of actual and optimum growing stocks and allowable cuts, and computation of other values needed for forest management planning. Computed volumes and areas are summarized in a timber management guide that replaces a conventional management plan. Effects of cultural operations and other changes are accounted for in computation of both actual and optimum conditions.

122
MYERS, Clifford A, and Carleton B. Edminster.

1974. Conversion of tree-volume equation to the metric system. USDA Forest Serv. Res. Note RM-261.

Abstract
Presents factors for converting volume equations of the form $V = a + bD^2H$ from U.S. customary to metric units.

123
NASH, A. J., T. Cunia, and K. Kuusela, Editors.

1973. Forest resources inventory. Proceedings of the IUFRO Meeting of Subject Group S4.02, Nancy, France. 25-29 June 1973. Vol. 3. Columbia, USA, School of Forestry, Fisheries and Wildlife, Univ. of Missouri, 126 pp.

Abstract

Comprises nine papers, in English unless otherwise specified as follows: Which components of forest inventory need research urgently? (F. Loetsch; 6 pp.) [an appendix compiled by F. Loetsch and F. Zohrer lists 'Twenty-one problems of inventory methodology deserving future research' - cf. FA 34, 5948]; Methodology and practice in tropical forest inventory (J. Clement; F. Cailliez; F. Guinaudeau; 20 pp.; Fr; 20 ref.) [cf. FA 35, 2546]; Inventory methods in the tropical rain forests of Surinam (A. J. Nash; 5 pp.); Regional timber resources survey [Victoria, Australia] (R. B. Smith; A. W. Webb; 7 pp.; 1 ref.); The evaluation of a boring for decay program undertaken in a Malaysian tropical forest (E. W. Hindley; 5 + 49 pp.; 2 ref.); Reduced basal area, reduced volume and taper function (D. J. M. Cervera Ibanez; 6 pp.; Fr); Activities of FAO in the evaluation of forest resources (J. P. Lanly; 7 pp.; Fr); Growth simulation of forest stands under intensive silviculture (J. Rondeux; 15 pp.; Fr, en; 16 ref.); Unequal probability sampling by DBH cumulator (J. Laasasenaho; 6 pp.; 5 ref.).

124
NAVON, Daviel I., and Richard J. McConnen.

1967. Evaluating forest management policies by parametric linear programming. U.S. For. Serv. Res. Pap. PSW-42, 13 pp.

Abstract

An analytical and simulation technique, parametric linear programing explores alternative conditions and devises an optimal managment plan for each condition. Its application in solving policy-decision problems in the management of forest lands is illustrated in an example.

125
NELSON, Tom, and F. A. Bennett.

1965. A critical look at the normality concept. J. Forest. 63:107-109.

Abstract

This paper documents definitons on normality and full stocking - the subjective nature of the terminology concerning normality - and evaluation of the concept. The theoritical and practical limitations in the use of normality in growth and yield studies are developed, including relativity of normal tables, biological weakness of overstocking, correction of yields for normal stands, disregard for tree size, and lack of economic and management optimization.

126
NEWNHAM, R. M.

1973. Process control in forest harvesting. The Forestry Chronicle, Vol 49, No. 1, February.

Abstract

Process control monitors changes that may take place with time and feeds back information about them to the planner or decision maker. This paper discusses "Process control" in relation to forest harvesting.

127
NIELSON, U.

1971. Tree and stand measurements from aerial photographs: an annotated bibliography. Information Report FMR-X-29. Forest Management Institute, Dept. of the Environment, Ottawa, Ontario.

Abstract

Results of research papers dealing with tree and stand measurements from aerial photographs were summarized and are presented in a standardized format. It is concluded, that the complexity of the factors involved in the photographic and photogrammetric processes is the main reason for frequent contradictions. A more organized approach to the problem, as well as inclusion in publications of all information likely to influence the results of experiments, is highly recommended.

128
NIELSON, U.

1974. Aerial Survey. Description and performance of the forestry radar altimeter. Information Report, Forest Management Institute, Canada No. FMR-X-59, [En, fr, 6 ref.].

Abstract
Describes the altimeter [cf. FA 30, 4477] and gives results of the latest tests with it. They show that the main object of the system, viz, precise measurement of the distance between aircraft and ground, disregarding intervening vegetation, has been achieved for forest conditions in eastern Candaa. The error of the altimeter is independent of flying height above the ground. Over a flat surface, the accuracy of the altimeter is within the design specifications, the error being ≠ 1% of flying height at the 95% probability level throughout the instrument's range (240-1100 m). Over irregular terrain, the absolute error was found to be ca. 6 m over the complete range. This accuracy is sufficient for forest inventory purposes.

129
OHMANN, Lewis F.

1973. Vegetation data collection in temperate forest research natural areas. USDA For. Serv. Res. Pap. NC-92, 35 pp.

Abstract
Despite a long history of research natural area preservation by the USDA Forest Service and other governmental agencies, ecological baseline data have been gathered for few areas. This report presents a framework, including possible sampling schemes, for ecological baseline data collection by non-professionals working under the consulting supervision of professional ecologists, botanists, or foresters.

130
PATUNOFF, A.

1974. Forest inventory summary. Job No. FPO-45110. Dept. of For. and Parks, Agency of Environmental Conservation, Montpellier, VT.

Abstract
A computer program set up to store natural resource data.

131
PEET, F. G.

1977. A digital image interpretation system for under $100,000. Information Report, Forest Management Institute, Canada, No. FMR-X-94.

Abstract

This report summarizes the approach taken by the Forest Management Institute to the development of a basic, comparatively inexpensive digital image interpretation system based on a minicomputer. Included are a brief background to the problem, the definition and requirements of the system, the hardware description, enhancements and intitial software. The report should be of use to those contemplating the purchase of a digital image interpretation system but constrained by cost and other resources.

132
PFISTER, Kovalchib, Arno, and Prisby.

1977. Forest habitat types of Montana. USDA For. Serv. Gen. Tech. Rep. INT-34.

Abstract

This report develops a habitat type classification for the forested land of Montana, describes the general geographic, physiographic, climatic, and edaphic features of each type, describes the mature forest communities as well as the potential climax communities characteristic of each type. It also presents information on successional development, timber productivity potential, and other biological observations of importance to land managers. The main feature of the report is to develop and test a reconnaissance-plot method of data gathering that would permit accurate habitat classification in a minimum period of time.

133
POOLE, Robert W.

1971. The use of factor analysis in modeling natural communities of plants and animals. Illinois Natural History Survey, Biological Notes, No. 72, Urbana, IL.

Abstract

This paper is divided into three parts. The first gives a brief review of basic ecological principals necessary for the following two. The second describes the statistical procedures considered and the analysis of a specific example. The third considers the assumptions of the factor analytic model and compares them to the initial ecological generalities to see if the model mirrors the working of the community or if it only produces a set of mathematically correct but ecologically meaningless numbers.

134
PREVOST, M. J., P. F. Banks, and J. H. Gwyther.

1972. Forest inventory. Procedures for coniferous plantations in the eastern districts of Rhodesia. For. Res. Pap. No. 2. Rhodesia Forestry Commission, Research Division.

Abstract
Management of fast growing confiers in Rhodesia necessitates frequent and accurate appraisals of the growing stock. Earlier procedures do not meet present needs and a new approach utilizing point sampling and computer processing of data has been developed. A code for net percentage utilization loss on sawlog conversion is included in the descriptions of the adopted procedures.

135
RENNIE, John C.

1977. STX, a computer system for processing inventory data, prepared by John C. Rennie, Assoc. Prof., Dept. of Forestry, Wildlife and Fisheries, Univ. of Tenn., Knoxville, 37916. Presented at Sampling Techniques and Timber Inventory Systems Workshop, Univ. of Georgia, Center for Continuing Education, Athens, 29 August - 2 September.

Abstract
This publication gathers together data about the STX from a number of publications.

136
RENSI, Giuseppe, and H. Dean Claxton.

1972. A data collection and processing procedure for evaluating a research program. USDA For. Serv. Res. Pap PSW-81, 18 pp.

Abstract
A set of computer programs compiled for the information processing requirements of a model for evaluating research proposals are described. The programs serve to assemble and store information, periodically update it, and convert it to a form usable for decision-making. Guides for collecting and coding data are explained. The data-processing options available and instructions on operation of the software are outlined.

137
REUKEMA, Donald L.

1970. Forty-year development of Douglas-fir stands planted at various spacings. USDA For. Serv. Res. Pap. PNW-100, 21 pp.

Abstract
A 40-year record from a Site IV plantation illustrates greater tree and stand growth and lesser impact of mortality and damage on wide spacings than on close spacings. Furthermore, without fairly wide initial spacing, few trees reached a size where they could have been removed in commercial thinnings.

138
RUSSELL, Robert M., David A. Sharpnack, and Elliot L. Amidon.

1975. Wildland resource information system: user's guide. USDA For. Serv. Gen. Tech. Rep. PSW-10, 36 pp.

Abstract
This user's guide provides detailed information about how to use the computer programs of WRIS, a computer system for storing and manipulating data about land areas. Instructions explain how to prepare maps, digitize by automatic scanners or by hand, produce polygon maps, and combine map layers, Support programs plot maps, store them on tapes, produce summaries, and perform housekeeping tasks.

139
RUSSELL, Robert M., David A. Sharpnack, and Elliot L. Amidon.

1975. WRIS: a resource information system for wildland management. USDA For. Serv. Res. Pap. PSW-107, 12 pp.

Abstract
WRIS (Wildland Resource Information System) is a computer system for processing, storing, retrieving, updating, and displaying geographic data. The polygon, representing a land area boundary, forms the building block of WRIS. Polygons form a map. Maps are digitized manually or by automatic scanning. Computer programs can extract and produce polygon maps and can overlay, plot, and store them, as well as aggregate acreages and print summaries. WRIS is functionally oriented toward timber management, but can be used for other types of resource activities.

140
SAYN-WITTGENSTEIN, L.

1977. Remote sensing and today's forestry issues. Presented at the Proceedings of the 11th International Symposium on Remote Sensing of Environment, April 1977 (Environmental Research Institute of Michigan, PO Box 618, Ann Arbor, MI 48107). Reprinted by Forest Management Institute, Canada Forestry Service, Dept. of Fisheries and the Environment, Ottawa, Canada.

Abstract

The purpose of this paper is to examine the actual and the desirable roles of remote sensing in dealing with current forestry issues, such as national forest policy, supply and demand for forest products and competing demands for forest land.

A most critical problem in forestry is the developing shortage of wood. Productivity must be increased, more intensive management must be introduced, and current supply must be accurately estimated. Significant uses for both satellite and airborne data have developed in forest management and broad regional planning. However, the shortage of wood has emphasized the weakness of existing forest inventories and has increased the importance of those projects which lead to more detailed information on forests coming under intensive management. Projects involving multistage sampling, linking information flowing from aerial photography and ground sources are now particularly relevant, as are the developments in low altitude aerial photography. Since a high percentage of the cost of wood is incurred in harvesting and transportation, remote sensing should pay increasing attention to terrain assessment, trafficability and other information required in planning harvesting operations and transportation networks. Special problems have to be solved in the inventory and management of resources in developing countries.

The developing supply crisis will put pressure on reforestation programs, and on the rehabilitation of naturally degraded or mismanaged lands. At the moment, the most promising approaches to the assessment of planting sites and reforestation success are through adaptations of traditional photogrammetry and photo interpretation; advances will have to be made.

Forest protection continues as a critical area deserving more attention. Satellite data have proved valuable in assessing forest fuels and fire damage and thermal imagery has contributed in fire detection, mapping and suppression. However, the practical advances in the appraisal of insect damage from thermal imagery and satellites have been less spectacular and particularly in the assessment of the spruce budworm damage, major problems remain.

Wood is also being considered as an additional source of energy and interest is increasing in producing fuels from wood. These approaches have posed the new problems of estimating total biomass and transportation costs for new products. The estimates required are those which are directly relevant for industrial developments; the purely scientific approach is less desirable.

Other forestry issues involve concerns for the quality of life, conservation and environmental protection. Here remote sensing has served well in the completion of integrated resource inventories of parks and conservation areas and in thematic mapping. It has also been employed in urban forestry, in assessing the problems and potential of trees in cities and it plays a special role in environmental assessments preceding large capital projects, such as dams, pipelines and transportation corridors. Satellite imagery has a promising role in large national and global monitoring programs which emphasize both the monitoring of resources and environmental matters.

141 SAYN-WITTGENSTEIN, L., and A. H. Aldred.

1969. The choice of sample plots for a forest inventory using large-scale aerial photographs. Information Report FMR-X-17. Forest Management Institute, Ottawa, Canada.

Abstract

This report describes how the size and shape of the sample plots were chosen for a forest inventory by large-scale aerial photography. The method may be of value for similar inventories in the future.

142 SCHMID-HAAS, Paul (Editor).

1976. Inventories on successive occasions. Working Group S-4.02.3. International Union of Forest Research Organisations. Papers presented at the XVIth IUFRO World Congress in Oslo, June 20-July 2, 1976.

Abstract

Includes papers presented at the above meeting. Topics are: Sampling Designs for Continuity in Forest Inventory, Tree-Sampling, Forest Inventory Data and Construction of Growth Models, Stand Projection, Mean Annual Volume Growth from Sequential Volume Determination on Permanent Aerial Photographic Plots, Monitoring, Forest Environment with Photo Densitometer through Successive Sampling, The Northern Ireland State Forest Inventory and Production Forecast, Accuracy in Pre-Sale Timber Inventory.

143
SCHMID, Paul

1971. Continuous forest inventory in Switzerland. Swiss For. Res. Institute, Birmensdorf, Zurich.

Abstract

Explains the Forest Inventory System for Switzerland, and reasons why it is used.

144
SCHMID, Paul and John Werner.

1970. Swiss continuous forest inventory. Swiss For. Res. Institute. Birmensdorf, Zurich.

Abstract
A "how to do" paper on Swiss inventory systems, including stand classification, number of sample plots, equipment, locating of plots, measurement, etc.

145
SEGEBADEN, G., Sweden, Ragnar Stromnes, Norway, and Herbert I. Winer, Canada.

1967. Proposal for international system of terrain classification by The Working Group on Terrain Classification, IUFRO, 14th Congr. Munich, Sect. 31-32, VIII:756-764.

Abstract
The system described the most important terrain factors which effect forest management. Terrain factors which can be described objectively are used as much as possible. The system does not specify on how detailed or what is the minimum to be recognized.

146
SHELTON, Ronald L. and Ernest E. Hardy.

1971. Cornell environmental inventory and planning techniques. Univ. of Illinois at Urbana-Champaign, Urbana, IL 61801.

Abstract
Cornell techniques for conducting environmental inventories, and experience in assisting others to establish similar techniques, are summarized under eight general headings: design, classification, data acquisition, geographical referencing, data processing, data storage, data retrieval, and applications. Both inventory and data system aspects of environmental planning are discussed, with techniques referenced to those used for the New York State Land Use and Natural Resources Inventory and for a similar project of the Hudson River Valley Commission.

147
SHEPPERD, Wayne D.

1973. An instrument for measuring tree crown width. USDA Forest Serv. Res. Note RM-229.

Abstract
A small, handheld instrument for measuring tree crown widths has proved to be accurate, and has several advantages over existing equipment. A materials list and construction diagram are included.

148
SMITH, Victor G.

1976. Canadian forest inventory methods. The Forestry Chronicle, Feb. Univ. of Toronto, Toronto, Canada.

Abstract
The various provincial forest inventory methods are compared on the basis of base maps, photo interpretation, ground plots, stand volume tables, growth estimation and reinventory. Comments are made suggesting areas in which problems exist and where improvements in the various methods can be made.

149
SPACE, James C., William E. Balmer, and H. Gyde Lund.

1976. Computer programs for forest management planning on small ownerships. U.S. For. Serv., State and Private Forestry, Wash., D.C.

Abstract
The study identified and evaluated computer programs which could be used by Service and Consulting Foresters in the development of management plans for tracts less than 1,000 acres in size. Included are programs for stand accounting, cruising and inventory, resource allocation modeling, and financial analysis. Only non-proprietary programs were considered.

To be considered, a program had to be sufficiently general in nature that extensive reprogramming was not necessary, have instructions clear enough to be used by the typical Service Forester or consultant, and well documented so that making necessary changes would not be an insurmountable problem. The facilities and procedures necessary for use of the program by field personnel were also a major consideration.

150
SPACE, James C.

1973. Three-p forest inventory. State and Private Forestry - Southeastern Area, Atlanta, GA, 30309. 26 pp.

Abstract
The report covers the design, procedures, and data processing for 3-P inventory.

151
SPACE, C. and Doyle Turman.

1977. Three-p sampling: an efficient sampling technique for forest inventory. Presented at the XVIth IUFRO Congress, Oslo, Norway, June 20-July 2, 1976, pp. 15-22, Inventories on Successive Occasions, Working Group S4.02.3, International Union of Forest Research Organization. Reports 171, Swiss Federal Institute of Forest Research, CH 8903, Birmensdof.

Abstract
Recent applications have demonstrated a variety of uses for 3-P sampling. Three-P sampling offers a valuable alternative for sampling populations where each tree can be visited. It has found increasing use in more elaborate multi-state sampling schemes utilizing equal probability, 3-P, and variable probability list sampling. Three-P sampling can be used in any application where a relative volume or value can be assigned to prospective samples.

152
SPRACKLING, John A.

1973. Soil-topographic site index for Engelmann spruce on granitic soils in Northern Colorado and Southern Wyoming. USDA Forest Serv. Res. Note RM-239.

Abstract
Site index of Engelmann spruce and be estimated from soil depth to the C horizon and elevation. Predictions should be confined to potential spruce-fir sites on granitic soils in northern Colorado and southern Wyoming.

153
STAGE, Albert R.

1975. Prediction of height increment for models of forest growth. USDA For. Serv. Res. Pap. INT-164, 20 pp.

Abstract

Functional forms of equations were derived for predicting 10-year periodic height increment of forest trees from height, diameter, diameter increment, and habitat type. Crown ratio was considered as an additional variable for prediction, but its contribution was negligible. Coefficients of the function were estimated for 10 species of trees growing in 10 habitat types of northern Idaho and northwestern Montana.

154
STAGE, Albert R.

1975. Picturing the future forest from regeneration surveys--a research program and scale for defining adquate stocking. (INT R-417) Proc. Permanent Assoc. Comm., pp. 74-76. 65th West. For. Conf., Spokane, WA.

Abstract

Discusses a stocking measurement scale that is consistent with empirical studies of regeneration development. It permits a single plot size to be used for a moderate range of levels of stocking standards, retains the emphasis on spacing that has been the strong point of the conventional stocked quadrat methods, and is compatible with the needs of regeneration development models.

155
STAGE, Albert R.

1973. Prognosis model for stand development. USDA For. Serv. Res. Pap. INT-137, 32 pp.

Abstract

Describes a set of computer programs for developing prognoses of the development of existing stands under alternative regimes of management. Calibration techniques, modeling procedures, and a procedure for including stochastic variation are described. Implementation of the system for lodgepole pine, including assessment of losses attributed to an infestation of mountain pine beetle, is described.

156
STAGE, Albert R. and Jack R. Alley.

1972. An inventory design using stand examinations for planning and programing timber management, USDA For. Serv. Res. Pap. INT-126, 17 pp.

Abstract

Considerations guiding the design of a forest inventory for providing "in place" data for planning and programing timber management are discussed. A design is described for an inventory intended to be transitory between previous inventories that provided estimates only of forest totals and later inventories that could use a complete forest record of "in place" data.

157
STAGE, Albert R.

1971. Sampling with probability proportional to size from a sorted list. USDA For. Serv. Res. Pap. INT-88, 16 pp.

Abstract

Describes a sampling technique and related computer program for drawing a sample with probability proportional to size from a list of the population elements and their corresponding sizes. The sampling process is systematic, without replacement.

158
STAGE, Albert R., Richard C. Dodge, and James E. Brickell.

1968. NETVSL--a computer program for calculation of tree volumes with interior defect. U.S. For. Serv. Res. Pap. INT-51, 30 pp.

Abstract

This comprehensive computer program, written in FORTRAN IV language, calculates gross and net volume, surface area, and length from stem measurements. Tree input data include measurements of lengths, diameters, and cull dimensions obtained from felled trees; gross volumes of standing trees may be computed from Barr and Stroud optical dendrometer measurements. Volume units include cubic feet, Scribner and International 1/4" log scale. Various merchantability standards can be applied simultaneously to identical input data to obtain correspondingly various volume data output. This paper includes typical instruction for collecting and compiling tree data.

159
THIE, J. and Ironside (editors).

1976. Ecological (biophysical) land classification in Canada. Canada Committee on Ecological Land Classification, Petawawa, Ontario.

Abstract
Gives the papers presented at the Canada Committee on Ecological Land Classification, 25-28 May, 1976. Topics range broadly, from classification from helicopter, to mapping, soil surveys, etc.

160
TRAVIS, Michael R., Gary H. Elsner, Christine G. Johnson, and Wayne D. Iverson.

1976. VIEWIT: computation of seen areas, slope, and aspect for land-use planning. USDA For. Serv. Gen. Tech. Rep. PSW-11, 70 pp.

Abstract
This user's guide provides instructions for using VIEWIT - a computerized technique for delineating the terrain visible from a single point or from multiple observer points, and for doing slope and aspect analyses. Results are in tabular or in overlay map form. VIEWIT can do individual view-area, slope, or aspect analyses or combined analyses, and can produce elevation profile charts between any two points in a study area. The guide explains how to prepare data, select available options, and interpret results. VIEWIT is designed to operate on a Univac 1108 computer with Exec-8 operating system. The VIEWIT system is accessible via remote terminals to the USDA Fort Collins Computer Center. For those not having access to this computer facility, the programs are available on request to: Director, Pacific Southwest Forest and Range Experiment Station, P.O. Box 245, Berkeley, California, 94701, Attention, Computer Services Librarian. The programs will be copied on a magnetic tape to be supplied by the requestor.

161
TITUS, Stephen J., Lee C. Wensel and Robert N. Colwell.

1977. Development of sampling design to use with remotely sensed data for national resources inventories. Final Report, USFS Coop. Agreement No. 16-640-CA, Dept. of Forestry and Natural Resources, College of Natural Resources, University of California, Berkeley, CA 94720, 205 pp.

Abstract
This report documents procedures, results, and recommendations for modifying sample survey systems implemented by the US Forest Service to assess renewable natural resources at the national and regional level. Western Washington is the regional area to which the study was addressed. Particular emphasis is given to the role of remote sensing

data sources as inputs to both the design and implementation phases of surveys to provide information used in making resource assessments. All data files and programs used in this analysis have been maintained as permanent files available under Forest Service accounts at the Lawrence Berkeley Laboratory, Computer Center. Several magnetic tape files are maintained by the Remote Sensing Research Program, U.C. Berkeley.

162
TURNER, Brian J.

1971. Aspects of the development of management information systems in Austrialian forestry. School of Forest Resources, Pennsylvania State University, University Park, PA 16802.

Abstract
Australia being at present a net importer of timber products, has set a national goal of self-sufficiency by 2000 AD, and the state forestry organizations have all embarked on expanded plantation programs to achieve this. This has been the impetus for the development in some state and private organizations of large-scale plantation simulation models as the core of comprehensive planning and control systems which qualify in many respects as management information systems. The implementation of these systems may cause some organizational problems.

163
USDA Forest Service.

1974 to 1976. Analysis of computer support system for multi-functional planning, Vol. 1, 2, 3, and 4. Management Sciences Staff, USDA Forest Service, Berkeley, CA.

Abstract
The study pertains to the existing Forest Service computer support systems for multi-year program planning and land use planning, with particular emphasis on forest level planning. The study objectives are to determine:

1. The types of planning situations for which existing systems are to be used.

2. The utility of these systems.

3. The applicability and transferability of these systems to a variety of locations.

4. The gaps wherein no computer support systems for planning exist or are being developed, and priorities for closing the gaps.

5. The criteria for managing systems development including alternative strategies for implementing systems and requirements for training users.

164
USDA Forest Service.

1976. QRD, a concept for today....and tomorrow; an executive summary, July. USFS - Forest service, Intermountain Forest and Range Exp. Station.

Abstract
The summary is based on studies by: Dept. of Forestry and Outdoor Recreation, Utah State University, Ogden, UT.

QRD (Question, Rule, Data) is a decision-aiding approach, to answer about an action which may affect the environment. The paper gives the land-manager an overview of the QRD concept.

165
USDA Forest Service.

1976. Rocky mountain forest and range experiment station: A list of published research, April 1, 1972 through March 31, 1976. USDA For. Serv. Gen. Tech. Rep. RM-31, 59 pp.

Abstract
Provides an annotated list of Station publications printed during the research years April 1, 1972 through March 31, 1976. Publications are organized by subject categories: Forest Management, Range and Wildlife Habitat Management, Watershed Management, Fire and Atmospheric Sciences, Forest Insects and Diseases, Recreation, Resource Assessment and Economics, Forest Products, Other.

166
USDA Forest Service.

1976. Land system inventory guide. USDA Forest Service, Northern Region, Missoula, MT.

Abstract
This is a handbook on a narrow section of the whole land system inventory scheme--the landtype--since this is the level at which the inventory is presently being conducted.

Summary
Extensive areas of National Forest land in Region 1 have already been inventoried at the landtype level. Experience in Region 1 has demonstrated that an analysis of the inferred geomorphic history of landscapes and the formation of mapping units based on this analysis as defined in terms of low-order stream features, local relief and slope shapes, produces mapping units with predictable reoccurring patterns of soils and habitat types. This procedure then facilitates the mapping of large areas of land using photo interpretation with

a minimum of field checking. Landtype inventories have been an ideal tool for inventorying of land potential in steep, forested, mountainous terrain. They provide a maximum of land information with a minimum of investment. The kind of information produced and its reliability is adequate for most management decisions at the resource allocation level.

167
Utah Cooperative Wildlife Research Unit.

1976. Guidelines for line transect sampling of biological populations. Prepared for U.S. Fish and Wildlife Service - Office of Biological Services by Utah Cooperative Wildlife Research Unit, Utah State University, Logan, UT.

Summary

Proper estimation of density via transect sampling schemes involves a mix of basic statistical sampling theory and knowledge of the biology of the population under study. Ten important points to consider in designing a survey are suggested:

1) the center line of the transect(s) must be straight and well marked. The observer must be able to determine the position of the line at all times. In some cases, a series of straight line segments will suffice.

2) care must be taken to assure that objects on the center line of the transect are seen with probability one. In practice, this often can be met if the observer walks carefully along the center of the line transect at all times.

3) we recommend that the width of the transect be taken as quite large, or effectively unbounded. Outlier data can be deleted, if necessary, during the analysis.

4) all measurements of distances and angles must be accurate. Use a steel tape or other appropriate device to assure a high degree of accuracy. Careless measurements and rounding errors lead to poor estimates of density and sampling variances.

5) at this time, we are recommending that all three basic measurements be taken: right-angle distance, sighting (flushing) distance, and sighting (flushing) angle.

6) the measurements should be recorded separately for each segment (say ℓ i, where $\Sigma \ell i = L$) of the total transect length.

7) as a practical minimum, studies should be designed to assure that at least 40 objects are seen ($n > 40$), and it might be preferable if the length (L) were sufficient to allow the location of at least 60-80 objects ($n > 60\text{-}80$).

8) a pre-survey is recommended to aid in planning the survey design. Often, a simple visit to the area to be surveyed, along with basic biological information about the animal and its habits and habitat, will be sufficient to design an adequate survey to estimate density.

9) attention should be given in designing the survey to assure that the population to be surveyed is not correlated with the sample line transects (e.g., avoid transects running along roads, ridgetops, streambottoms).

10) the survey should be conducted using competent, interested, and trained personnel. This point is particularly important concerning points 1, 2 and 4 (above).

168
WAGAN, J. Alan.

1976. Land-use planning: A view from Holland. Jan. Vol. 74, No. 1, Journal of Forestry, pp. 13-17.

Abstract
Participation in a Dutch planning study suggested that public resource decisions require input from at least five groups: diverse specialists, interest groups, analysts, plan builders, and decision makers. Integrating these inputs requires emphasizing meanings rather than details, careful distinction between facts and values, and a defensible hierarchy of values. A computer mapping technique for identifying and defining alternatives is described.

169
WELCH, Richard L. and Robert A Cathey.

1976. Sampling and analytical techniques for an interim survey in the South Carolina Lowcountry. USDA For. Serv. Res. Pap. SE-154, 8 pp.

Abstract
Remeasurement of 675 permanent sample locations in the South Carolina Lowcountry using modified sampling techniques showed that net growth of pine for the 6 years 1968-1974 was 637.0 million cubic feet while removals were slightly over 390.6 million cubic feet.

170
WIANT, Harry V., Jr.

Combine 3p and point sampling for efficient cruising. Division of Forestry, West Virginia University, Morgantown, WV 26506.

Abstract
This paper describes how 3P sampling using local board foot factors provides for more efficient point sample cruises in sawtimber stands.

171
WIKSTROM, J. H. and S. Blair Hutchison.

1971. Stratification of forest land for timber management planning on the western National Forests, USDA Forest Serv. Res. Pap. INT-108, 38 pp.

Abstract
The area of forest land suitable and available for timber production on National Forests of the West has been overestimated, probably as much as 22 percent. Forest land misclassified for timber use includes (1) highly unstable land, (2) land low in timber productivity, (3) forest land devoted to nontimber use, and (4) patches and stringers of forest land too small and/or too isolated to be used in timber production.

172
WIRSING, John M. and Robert R. Alexander.

1975. Forest habitat types on the Medicine Bow National Forest, southeastern Wyoming: Preliminary report. USDA For. Serv. Gen. Tech. Rep. RM-12, 11 pp.

Abstract
A vegetation classification based on concepts and methods developed by Daubenmire was used to identify five habitat types and their related phases on the Medicine Bow National Forest: Abies lasiocarpa/Vaccinium scoparium, including the Pinus contorta/Vaccinium scoparium community; Abies lasiocarpa/Carex geyeri, including the Pinus contorta/Carex geyeri community; Populus tremuloides/Carex geyeri; Pinus ponderosa/Carex geyeri; and Pinus flexilis/Carex geyeri. A key to identify the habitat types and management implications associated with them are provided.

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